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ABSTRACT

This review describes some of the main research findings and issues that center around teachers' use of questions in classroom instruction. The paper is divided into sections dealing with: (1) the classification of questions by type, (2) teachers' questioning practices, (3) effects of teachers' questions on students' behavior, (4) students' questions, and (5) programs to improve teachers' questioning skills. Each section contains a separate review of the literature, a critical synthesis, and recommendations for future research. (See related document CS 000 187.) (Page 40 may be illegible.) (Author/TO)

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THE USE OF QUESTIONS IN TEACHING READING

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INTRODUCTION

This paper is based on a previously published review of the literature entitled, "The Use of Questions in Teaching" (Gall, 1970). It has been updated to include recent findings, and rewritten in order to highlight issues of particular concern to researchers specializing in reading instruction. Additionally, it reflects changes, and hopefully advances, in the author's thinking about this subject since the time the first review was written.

Many of the studies reviewed here involve classroom teaching in curriculum areas other than reading. Nevertheless, the findings are pertinent to the field of reading instruction because teachers cannot help but shape their students' reading behavior as they offer instruction in social studies, science, mathematics, and other subjects. Furthermore, the methodology of these studies can be applied by researchers to design investigations specifically concerned with the use of questions in teaching reading.

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Each section contains a separate review of the literature, a critical synthesis, and recommendations for future research.

THE CLASSIFICATION OF QUESTIONS BY TYPE

Review

Many researchers have attempted to describe the types of questions that teachers ask. To quantify their descriptions, some have found it helpful to develop sets of categories into which teachers' questions can be classified. At least eleven classification systems have been proposed in recent years: Adams, 1964; Aschner, 1961; Barrett, 1971; Bloom, 1956; Carner, 1963; Clements, 1964; Gallagher, 1965; Guszak, 1967; Moyer, 1965; Pate & Bremer, 1967; Sanders, 1966; Schreiber, 1967. The categories of representative question-classification systems are shown in Table 1. The categories are organized to show the similarities between the systems.

Insert Table 1 about here

Several systems, such as Bloom's, Gallagher's, and Carner's, consist of a limited number of general categories which can be used to classify questions irrespective of context. This feature enables the researcher to investigate issues such as the different types of questions emphasized in various school curricula (Pfeiffer & Davis, 1965) or in traditional or new curricula (Sloan & Pate, 1966). However, these systems are of limited utility if the researcher is interested in more detailed descriptions of questions asked in a specific context.

For detailed descriptions a classification system developed for a specific curriculum is preferable. One such system (Clements, 1964) was

designed to classify the questions asked by art teachers as they talk with students about their artwork. For example, the "suggestion-order" category includes questions such as: "Why don't you make the hands larger?"; "Why not put some red over here?"; "Why don't you use freer lines?" This type of question, which occurs frequently in art classes, is not adequately described by any of the categories in the more general systems. In Schreiber's system for classifying social science questions, there are also a number of fairly curriculum-specific categories, such as Use of Globes (e.g., "Will you find Greenland on the globe?") and Stating of Moral Judgments (e.g., "Do you think it is right to have censorship of the news?").

Guszak's Reading-Comprehension Question-Response Inventory (1967) is a specific classification system designed for the analysis of questions that teachers ask elementary school reading groups. The specificity of the categories is typified by the "recognition question" category, which includes questions requiring students to locate information from the reading context (e.g., "Find what Little Red Ridinghood says to the wolf.").

Recently Barrett (1971) developed a more complex taxonomy of reading comprehension based in part on the earlier work of Guszak and Bloom. His categories of question types are listed in Table 2.

Insert Table 2 about here

Most of the question classification systems are composed almost entirely of categories based on the type of cognitive process required to answer the question. For example, in Bloom's taxonomy, the question, "What is your opinion of our present stance on the Vietnam War?" is

classified as an evaluation question because it requires evaluative thinking, whereas "What assumptions does the author make in criticizing New Deal politics?" is classified as an analysis question because it requires students to engage in analytic thinking. Perhaps the best known and most widely used system is the one developed by Bloom. The systems developed by Guszak and Barrett are essentially specialized modifications of Bloom's taxonomy.

A few researchers have been concerned with classifying types of question sequences and strategies. For example, some educators believe that teachers should start a discussion by asking recall questions to test students' knowledge of facts and then ask higher cognitive questions that require manipulation of these facts. This was the approach taken by Taba (1964, 1966) in attempting to identify questioning strategies that stimulate students to reflect on curriculum materials at increasingly abstract levels. In Shaver's model of Socratic teaching (1964), another type of question sequence was proposed: the teacher asks the student for a statement of his position on an issue, then asks appropriate follow-up questions to probe the student's stated position.

Synthesis

The question classification systems described above are important in that they represent attempts to map the variety of cognitive abilities which students should possess in order to be considered "thinking" individuals. For example, the systems developed by Guszak and Barrett, although designed primarily to describe teachers' questions, also

describe the cognitive abilities that are involved in "thoughtful" reading or, stated another way, reading "with good comprehension". Their taxonomic work suggests that reading comprehension is not a unitary cognitive process, but instead involves a number of different cognitive processes (recall, analysis, evaluation, etc.). If this is true, then perhaps teaching for good reading comprehension is a more complex task than we have been accustomed to imagine.

Another contribution of these classification systems is that they suggest that different types of questions stimulate the development of different cognitive abilities. Thus, as we shall see later, they can be used as a basis for training teachers to pursue higher cognitive objectives in their classroom instruction.

However, the cognitive process approach to question classification is not without certain drawbacks, chief of which is the fact that cognitive processes are inferential constructs, and therefore cannot be observed directly. Bloom (1956) acknowledged this difficulty in his statement that it is not always possible to know whether a student answers a particular question by using a high-level cognitive process, such as analysis or synthesis, or by using the relatively low-level process of knowledge recall. The question, "What are some similarities between the Greek and American forms of democracy?", probably stimulates critical thinking in some students. However, this question may only elicit rote recall if students answer by recalling comparisons they have read in a textbook.

To deal with this problem, the researcher can control the lesson material on which the teacher bases his questions. For example, he might

have a sample of teachers give the same reading assignment to some of their students. Preferably the assignment would be on a subject new to the students. The teachers would then ask discussion questions on this assignment and the questions could be classified as recall or higher-cognitive depending on whether the answer was given directly in the assignment. Furthermore, if the researcher is studying differences between teachers in question-asking skill or is studying improvement in this skill as a result of a training program, the use of a constant lesson topic makes it possible to attribute variance in question-asking to the teachers rather than to differences in the lessons. With two exceptions (Gall, Dunning, Banks, and Galassi, 1972; Hunkins, 1966, 1967) the studies reviewed here did not make use of this important control technique.

Another limitation of existing question classification systems is that they were designed primarily to investigate the types of questions which teachers actually use in the classroom, not the types of questions which teachers <u>should</u> use. Many of the question types shown in Tables 1 and 2 undoubtedly are of pedagogical significance. However, researchers have not ventured to determine whether some question types (and the particular cognitive processes which they elicit) are more important than others, or to provide a rationale for their importance. Also, they have overemphasized questions considered in isolation from each other. Relatively little attention has been given to the problem of classifying <u>sequences</u> of questions which occur during instruction.

Recommendations

As indicated above, we need to learn more about the relative value of various cognitive processes and the types of questions which stimulate their development. For example, Barrett's system describes twenty-three different cognitive processes. Are they all of equal importance in learning to read with good comprehension? Survey research might help us answer this question. A system such as Barrett's could be presented to teachers at various grade levels as well as to acknowledged reading experts, and they could be asked to select those question types that are of greatest importance in fostering good reading comprehension. The results of this research could be used to design new reading curricula and also to help teachers focus their question-asking behavior on selected, important cognitive objectives. My observations of class discussions indicate that teachers tend to have discussions that wander; there is little pattern or focus in their questions. I suggest as a hypothesis that students would learn more if teachers would limit their scope to a few cognitive objectives.

I would place a high priority on investigations of question sequence. Shaver has identified one particularly important strategy: asking a student for his position on an issue (a higher cognitive question), then asking the same student follow-up questions to probe the student's stated position. Use of this technique might help teachers overcome the situation where the intent of their higher cognitive questions is undermined by weak student answers. Here is a typical situation. The teacher asks a question such as, "What do you think can be done to solve the problem

of air pollution?"; this would be classified as a higher cognitive question in most question classification systems. A student answers, "Make sure all cars and trucks have smog control devices." Did the student really have to think to answer this question? He may have considered the problem in depth and decided that smog control is the best solution. However, it is more likely that the student is repeating a solution he has heard or read about. To really test the student's ability to think about the problem and to stimulate the development of his thinking processes, the teacher should probably ask follow-up questions such as, "How would that solve the problem?"; "Isn't that being done already?"; "Is that a better solution than converting to electric or steam-powered cars?"

It would be quite informative to collect research data on teachers' use of this technique in reading group discussions. (One study in which such data were collected is described in the next section.) The research design is simple enough: observing discussions and making simple frequency counts of how often a teacher asks a given student a higher cognitive question, then asks the same student a follow-up question to expand, clarify, or otherwise improve on his original answer. It would also be of interest to know how often teachers ask several follow-up questions in a row, in effect creating a dialogue with the student.

STUDIES OF TEACHERS' QUESTIONING PRACTICES

Review

Educators generally agree that teachers should emphasize the development of students' skill in critical thinking rather than in learning and recalling facts (Aschner, 1961; Carner, 1963; Hunkins, 1966). Yet research spanning more than a half-century indicates that teachers' questions have emphasized facts.

Probably the first serious study of this issue was done by Stevens (1912). She found that, for a sample of high-school classes varying in grade level and subject area, two-thirds of the teachers' questions required direct recall of textbook information. Two decades later, Haynes (1935) found that 77% of teachers' questions in sixth-grade history classes called for factual answers; only 17% were judged to require students to think. In Corey's study (1940), three judges classified all questions asked by teachers in a one-week period in a laboratory high school. The judges classified 71% of the questions as factual and 20% as those which required a thoughtful answer.

Studies conducted in the last several years indicate that teachers' questioning practices are essentially unchanged. Floyd (1960) classified the questions of a sample of forty "best" teachers in elementary classrooms. Specific facts were called for in 42% of the questions. I summed Floyd's percentages of questions in categories which appear to have required thoughtful responses from students; these accounted for about 20% of the questions asked.

At the junior high school level, Hoetker (1967) found that 88% of the questions asked by nine English teachers during recitation lessons called for memory answers. A similar situation exists in high school teaching. Gallagher (1965) and Davis and Tinsley (1967) classified the questions asked by high school teachers of gifted students and by student teachers. More than half of the questions asked by both groups were judged to test students' recall of facts. Additional evidence of high school teachers' emphasis on fact recall can be found in the classic study by Bellack, Kliebard, Hyman, and Smith (1966). These researchers observed four class periods in each of fifteen New York City area eleventh-grade social studies classrooms. An analysis of their data by Hoetker and Ahlbrand (1969) indicates that 81% of these teachers' questions required only fact recall.

Guszak's study (1967) of teachers' questioning practices is of special interest since it was focused on observation of reading groups. A sample of reading groups at the second, fourth, and sixth grade levels were each observed for approximately five hours over a three day period. Teachers' questions were classified by type using the Reading Comprehension Question-Response Inventory, described earlier. Percentages of questions of each type are shown in Table 3. For all classrooms studied, fact questions (recall and recognition) predominated over questions requiring a thoughtful

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Insert Table 3 about here

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response; the former comprised 70% of all questions asked. Guszak observes that, "Although 15.3 percent of the teachers' questions were spent on evaluation questions, there seems to be some legitimate doubt about the

thinking depth they required. A close inspection of the questions in this category revealed that nearly all called for a simple 'yes' or 'no' response." This is an important point: the cognitive level of the teachers' question does not always indicate the cognitive level of the students' response. Data presented elsewhere in Guszak's study indicate that teachers make rather infrequent use of follow-up questions for the purpose of having students elaborate on these one-word answers.

Recently Tinsley and Davis (1971) took a somewhat different approach to the study of teachers' use of higher cognitive questions. They asked student teachers of high school social studies to plan questions for discussion and testing based on an assigned topic. Interestingly, when the questions were classified using a modification of Guilford's system, thought questions involving logical, reflective, divergent, and evaluative processes predominated (59% of the total questions asked). This finding suggests a discrepancy between teachers' ability to compose higher cognitive questions and their ability to put them into practice in the classroom.

Although the focus of this review is on teacher-constructed questions, it is worth briefly mentioning research on questions in textbooks and curriculum guides for use by teachers and students. In past decades, researchers (Cunningham, 1925; Curtis, 1943; Moore, 1926) found that textbooks of their time emphasized primarily fact questions. More recently, Davis and Hunkins (1966) analyzed questions contained in three current textbooks for elementary school social studies. Classifying these questions according to Bloom's taxonomy, they found a very high percentage of

knowledge questions (87%, averaged over the three textbooks). Most of the other questions were classified as reflecting a low level of comprehension.

In another recent study (Marksberry, McCarter; and Noyce, 1969), questions and activities suggested in teachers' editions of current elementary school texts in four curriculum areas were classified, again using Bloom's taxonomy. Most of the questions and activities required either knowledge or comprehension. The specific data for teachers' editions of reading textbooks is worth noting. For primary level texts, questions and activities at the knowledge and comprehension level comprised 91% of the total; for intermediate level texts, the percentage was only slightly lower (83%). These data reveal that teachers' guides are not helpful in stimulating teachers to use higher cognitive questions in their classroom teaching, nor do the textbooks themselves contain questions that stimulate students to respond at a higher cognitive level.

Although the cognitive levels of teachers' questions have received most attention from researchers, there has been some interest in other aspects of teachers' questioning behavior. For example, Borg, Kelley, Langer, and Gall (1970) made observations of 48 elementary school teachers' questioning behavior during a twenty-minute discussion period. They found that their sample of teachers repeated their own questions an average of 14 times, repeated students' answers an average of 31 times, and answered their own questions an average of five times, which is a particularly striking finding. The average pause between teachers' questions and elicitation of a student answer was only two seconds. During a five minute

sample of discussion, teachers elicited answers that were only about six words long on the average; furthermore, in this short period of time there was an average of six answers that were only one word in length. Consistent with findings of other studies reported above, Borg and his colleagues also found that about two-thirds of all teacher questions required simple recall. More positive findings were that teachers asked an average of eight follow-up questions designed to improve a student's initial response, and they used redirection (asking more than one student to respond to the same question) an average of 27 times. Wright and Nuthall (1970) calculated the frequency of these same behaviors, and others related to them, in primary grade teachers. Their findings also indicate that teachers have many poor habits related to questioning.

Morgan and Schreiber (1969) have identified a number of desirable and undesirable techniques that teachers use when asking questions in discussions. Among those not already mentioned, these educators recommend that teachers use precise wording in composing their questions, time their questions appropriately, and individualize questions for students of different abilities. Teachers are advised to avoid directing most of their questions to bright students or volunteers, asking leading questions, playing a guessing game with students, and asking questions about unimportant facts or issues. At present we have little research data concerning the frequency with which teachers engage in these behavior patterns.

Synthesis

The findings of studies on teachers' questioning practices are fairly consistent, although in some instances there are methodological flaws such as failure to report interrater reliability in classifying questions and lack of clarity in the definition of question categories. It is reasonable to conclude that in a half-century there has been no essential change in the types of questions which teachers emphasize in the classroom. About 60% of teachers' questions require students to recall facts; about 20% require students to think; and the remaining 20% are procedural.

We need to ask, of course, whether it is desirable for teachers to use such a high percentage of fact questions in class discussions. I believe that Guszak's opinion on this issue is one with which many educators, particularly those concerned with students' reading comprehension, would concur:

> "Conceivably, the expenditure of nearly seventy of a hundred questions in the literal comprehension areas may be justified. Unjustified, however, is the involvement of these so-called literal comprehension questions with retrieval of the trivial factual makeup of stories. In real life reading situations, readers seldom approach reading with the purpose of trying to commit all the minute facts to memory. Rather, the reader is more interested in getting broad understandings of the material, finding out specific things commensurate with his interests or other needs, etc. It would appear, then, that much of the recall questioning actually leads the students away from basic

> literal understandings of story plots, events, and sequences. It seems quite possible that students in these recall situations may miss the literal understanding of the broad text in their effort to satisfy the trivial fact questions of the teachers. Seemingly, if teachers want to get at utilitarian aspects of literal understanding, they would offer many situations (rather than the few evidenced) for translational activities wherein they could really determine the extent to which children were understanding the literal elements."
>
> Guszak (1967, p. 233)

Even though educators, past and present, have decried teachers' reliance on fact recall questions, we must still explain why the learning and recall of facts has been the primary objective of American education, at least as revealed by an analysis of teachers' questions.

One explanation is that although higher cognitive objectives are valued in American education, teachers need to ask many fact questions to bring out the data which students require to answer thought questions. Even though this explanation has merit, it can be argued that instruction in facts is best accomplished by techniques such as programmed instruction that do not require teacher intervention. The teacher's time is better spent in developing students' thinking and communication skills during discussions after the students have demonstrated an acceptable level of knowledge on a written test.

Another explanation of the research findings is that although educators have long advocated the pursuit of objectives such as critical thinking and problem solving, only recently have these objectives been incorporated systematically into new curricula. The relationship between curriculum change and teachers' questioning practices is illustrated in a recent study comparing teachers in the School Mathematics Study Group (SMSG) with teachers in a traditional mathematics program (Sloan & Pate, 1966). The researchers hypothesized that the two groups would differ in their patterns of questioning since the SMSG program emphasizes the objectives of inquiry and discovery. They found that, compared to the traditional math teachers, the "new math" teachers asked significantly fewer recall questions and significantly more comprehension and analysis questions.

Still another reason why teachers have emphasized fact questions over a half-century, as indicated in research findings, is the lack of effective teacher training programs. In their study of questions in mathematics teaching, Sloan and Pate (1966, p. 166) observed:

> "Although the School Mathematics Study Group teachers' use of questions evidenced their awareness of the processes of inquiry and discovery, these processes had not been fully implemented, as shown by the fact that these teachers used so few synthesis and opinion questions that the pupils were denied the opportunity to develop inferences from available evidence."

Therefore, Sloan and Pate advocated training teachers in effective questioning practices so the objectives of the "new math" can be realized.

Recommendations

The generalization that teachers place too much emphasis on knowledge objectives and too little emphasis on higher cognitive objectives is well documented. Rather than conduct additional descriptive studies of this phenomenon, researchers should concentrate on investigating such problems as: why do some teachers use higher cognitive questions more than others? How can this capacity be increased? How does increased use of higher cognitive questions affect student behavior? These problems are considered in more detail later in this paper.

Sloan and Pate's study, discussed above, suggests the interesting hypothesis that teachers' use of fact and higher cognitive questions is dependent on the type of curriculum materials available to them. This hypothesis could be tested easily by asking teachers to lead discussions based on different lesson topics assigned to students: for example, a poem, a traditional textbook chapter, a newspaper editorial, a film. On the basis of my own preliminary research findings, I hypothesize that teachers ask more higher cognitive questions about primary sources, e.g., poems and newspaper editorials, than about secondary sources (most school textbooks). If this is the case, the reading curriculum would need to be revised to include nontraditional types of subject matter.

EFFECTS OF TEACHERS' QUESTIONS ON STUDENTS' BEHAVIOR

Review

Teachers' questions are of little value unless they have an impact on student learning. Yet comparatively few studies of questioning have been concerned with the relationship between use of questioning techniques and student outcomes.

In a recent review of the literature, Rosenshine (1971) presented seven studies in which teachers' use of lower cognitive or higher cognitive questions was correlated with measures of student achievement. Nonsignificant relationships were obtained in four of the studies. Of the three studies in which significant results were reported, no stable pattern of relationship could be identified. For example, Kleinman (1964) found a significant positive relationship between use of higher cognitive questions and student achievement, but Spaulding (1965) found a significant negative relationship between these two variables. Rosenshine also reviewed two studies (Connors and Isenberg, 1966; Solomon, Bezdek and Rosenberg, 1963) in which teacher questions were classified into more than two cognitive levels. Significant relationships between question types and student achievement were obtained in both studies, but Rosenshine points out that is is difficult to interpret them.

The kind of research design used in these investigations is illustrated by the recent study of Wright and Nuthall (1970). A group of New Zealand teachers was asked to teach a lesson on the 'black-backed seagull' to children at about the third-grade level. The three ten-minute lessons on this topic were tape-recorded in order to obtain measures of

various teacher behaviors. After the third lesson, students were given a specially constructed test measuring their knowledge of the lesson content. The measures of teacher behavior were then correlated with residual achievement test scores. (Residual scores were obtained by subtracting obtained achievement scores from predicted scores based on a multiple regression analysis involving several other tests that were administered.) These residual achievement scores were positively correlated with a variety of teacher behaviors, including these questioning techniques: the percentage of fact questions asked by the teacher, r=+.46, but not the percentage of higher cognitive questions, r=.21; after a pupil response, redirection of the same question to another pupil, r=+.54; and use of thanks and praise following pupil responses, r=+.49.

Hunkins (1967, 1968, 1969) used a somewhat different research design to investigate the relationship between use of lower cognitive or higher cognitive questions and student achievement. Two experimental groups of sixth-grade students worked daily for a month on sets of questions which were keyed to a social studies text. In one group the questions stressed knowledge; in the other, analysis and evaluation questions were stressed. Question types were defined in terms of Bloom's taxonomy. Hunkins found that the analysis-evaluation group earned a significantly higher score on a specially constructed post-training test than did students who answered questions that stressed knowledge. The performance of the two groups was also compared on the six parts of the test which corresponded to the six main types of questions in Bloom's taxonomy: the analysis-evaluation group of students did not differ from the comparison group in achievement on subtests containing knowledge, comprehension,

analysis, and synthesis questions; they scored significantly higher on the subtests containing application and evaluation questions. Hunkins also determined whether the two groups differed on the Social Studies Inference Test (Taba, 1964) which measures four aspects of critical thinking: inference, caution, over-generalization, and discrimination. The analysis-evaluation group significantly outperformed the comparison group on just one subtest, that measuring caution.

Synthesis

The studies reviewed here indicate that teacher questions affect student achievement. However, the results are by no means consistent from one study to another. The disparity in results is probably due to many factors, including differences in selection of teachers, students, and techniques for measuring teacher behavior and student outcomes. Given the complexity of the relationships being investigated, researchers should give detailed descriptions of their procedures in reporting results. Unfortunately, sketchy descriptions are more often the rule than the exception.

Wright and Nuthall's study illustrates some of the methodological problems that occur in investigating teacher behavior/student outcome relationships. The most important problem is locating or developing a student outcome measure that is sensitive to the possible effects of a specific questioning practice. In Wright and Nuthall's study, the student achievement test measured students' knowledge of the black-backed seagull, which was the subject of the three lessons in which teacher questioning behavior was observed. The test contained 29 multiple-choice

items, which presumably allow for only one correct answer. In other words, the test content was focused on the lowest of the cognitive objectives described in Bloom's taxonomy. It should be no surprise then that students of teachers who emphasized lower cognitive questions in their lessons answered more of the test items correctly than students of teachers who did not emphasize them. Suppose, however, the researchers had developed an achievement test that measured higher cognitive abilities. It seems reasonable to hypothesize that students of the teachers who emphasized higher cognitive questions would do better on this measure.

Hunkins' study also is subject to the criticism that the student outcome measure was not sensitive to students' use of higher cognitive abilities. Although the daily sets of questions in his experimental treatments required students to write out their answers, multiple-choice items were used exclusively on the criterion achievement test. Again, it is difficult to imagine how higher cognitive objectives can be measured effectively in a multiple-choice test format.

Another kind of methodological problem arises from the use of correlational matrices in which many teacher behavior measures are related to one or more student outcome measures. For example, in Wright and Nuthall's research, 28 measures of teacher behavior were correlated with students' residual achievement scores. By chance alone, at least one of these correlations can be expected to be statistically significant at the .05 level. If the teacher behavior measures are highly intercorrelated, even more behaviors would be significant by the operation of chance. The best procedure for ruling out the possibility of chance findings when

many correlation coefficients are computed is to replicate the study, using the same measures but a different sample of teachers and students.

Interpretation of findings is further complicated by the use of correlational designs in all the studies reviewed. As an illustration, consider Wright and Nuthall's finding of a highly significant relationship between teachers' use of lower cognitive questions and student achievement. This finding does not mean necessarily that use of lower cognitive questions causes greater student achievement. Other interpretations are possible: it may be that a third factor mediates the relationship between these two behaviors, which themselves are not causally related. Researchers should use an experimental design if they wish to make reasonably unambiguous interpretations of a causal nature on the basis of their findings.

Recommendations

Much research remains to be done in mapping the complex relationships that exist between questioning techniques and student outcomes. Reading researchers need to become involved in this effort in order to discover relationships that are specifically applicable to reading instruction.

Further advances in this field will require the development of measures that are sensitive to possible student outcomes resulting from use of higher cognitive questions in oral and written situations. One might hypothesize that as students are exposed to such questions (and probing questions as well), the quality of their answers to them will improve. Little is known about the factors that make up this quality dimension.

It seems reasonable to state, though, that responses to fact questions can be evaluated by the simple criterion of correctness, but responses to higher cognitive questions require several criteria to measure their quality. Gall, Weathersby, and Dunning (1971) suggest these criteria as possibilities: (a) complexity of the response; (b) use of data to justify or defend the response; (c) plausibility of the response; (d) originality of the response; (e) clarity of the phrasing; and (f) the extent to which the response is directed at the question actually asked. There is probably at least a moderate correlation between length of the response and its quality, particularly as judged by criteria (a) and (b). Dealing with a related problem, Corey and Fahey (1940) obtained a correlation of +.50 between judges' ratings of the "mental complexity" of student questions and number of words in the question.

New measures are also needed to determine student outcome effects of other aspects of questioning. For example, consider teachers' use of redirection and avoidance of negative habits (repeating questions, repeating answers, answering own questions). Habitual and proper use or avoidance of techniques by a teacher may not affect student achievement, as traditionally measured, but it may affect how many students participate in a discussion, and their satisfaction with discussions as a learning experience. There are no readily available measures of such student outcomes at present.

As stable generalizations emerge from correlational studies, researchers should turn their attention to experimental designs. Suppose teacher use of higher cognitive questions is found consistently to be associated with student ability to think constructively about problems

and issues. The next step would be to conduct experiments in which teachers are trained to increase their use of these questions. If higher cognitive questions have a causal effect on student behavior, one should see an improvement in the quality of students' responses. However, gains in student achievement should not be expected immediately after teachers have completed training. It would be desirable to measure gains at several points during the school year in order to assess cumulative effects.

In doing studies of this problem, researchers should be aware of the many difficulties involved in measuring gain (Harris, 1963). Gain is often measured by subtracting a subject's score on a post-training test from his test score prior to training. However, the best approach currently available is to compare scores of the experimental group with scores obtained at the same point in time from a randomly-assigned control group. Subtracting one score from the other yields a measure of the gain attributable to the experimental method.

STUDENTS' QUESTIONS

Review

Some educators contend that our attention should be focused on questions asked by students rather than on teachers' questions (Carner, 1963; Wellington & Wellington, 1962). Certainly, it seems a worthwhile educational objective to increase the frequency and quality of student questions in the context of classroom interaction. However, research findings consistently show that students have only a very limited opportunity to raise questions.

Houston (1938) observed eleven junior high school classes and found that an average of less than one question per class period was student-initiated. Corey (1940) recorded all talk in six junior high and high school classrooms for a period of one week. The ratio of student questions to total questions varied considerably between classes: in two English classes, students accounted for 1% of the questions asked; seventh-grade and ninth-grade science students asked 17% and 11% of the questions respectively. At the primary grade level, Floyd (1960) found that student questions comprised 3.75%, 5.14%, and 3.64% of the total number of questions asked during a taped class session for samples of first-, second-, and third-grade classrooms, respectively. A low incidence of student questions was also reported for high school English classes (Johns, 1968) and for social studies classes at the elementary school (Dodl, 1966) and senior high school levels (Bellack, Kliebard, Hyman & Smith, Jr., 1966).

One explanation of these results is that children simply do not have the ability or desire to generate questions. However, Finley (1921) found that elementary school students had an average of about five questions each to ask when presented with an unfamiliar animal in class. Furthermore, Blank and Covington (1965) found that children's question-asking behavior can be increased by training based on programmed instruction. Prior to training, a sample of sixth-grade students asked an average of 3.6 questions each about problem situations presented in an oral situation. After about seven hours of training, they asked an average of 13.5 questions each in a similar situation. Significant gains were also made on a written criterion test, a science achievement test, and teacher ratings of class participation. The training appeared equally effective for children of low, average, and high ability.

Synthesis

This research demonstrates that students have few opportunities to ask questions of their own in classroom situations. However, they are capable of asking questions, and this capacity can be increased through training.

The primary weakness of these studies is their superficial approach to the phenomenon being investigated. Researchers have seldom dealt with the types of questions that students ask or should ask, nor have they specified instructional contexts in which it may be appropriate for the teacher to elicit student questions. Another problem is their reluctance to put forth theories about the role that student questions play in the learning process.

Recommendations

We know relatively little about the questions that students ask. Thus, reading researchers have many opportunities to make significant contributions in this field. Research on student questions should have high priority, particularly in view of the importance that educators attribute to them.

The paucity of student questions has been documented in various classroom settings, but not in reading instruction specifically. Therefore, research on their frequency in reading classes of various types would fill in a gap in our knowledge. The primary research thrust, though, should be investigations of the types of questions that students should be taught to ask in learning to read. Researchers should also be concerned with the issue of how teachers respond to students' questions and the role that these questions play in reading instruction.

To illustrate how such research might proceed, consider some questions that students might ask prior to a teacher's reading assignment. If students do not volunteer questions on their own (and research indicates they are likely not to), the teacher might encourage them by a statement such as, "Please ask any questions you may have about what you're going to read." Having collected a sample of students' questions elicited under these conditions, the researcher could analyze them to determine the types of questions asked and their value in the instructional process. For example, some students' questions may be concerned with clarifying the purpose of the assignment: "Why are we reading this?"; "Do we have to remember what we're going to read?"; "Does this have anything to do with what we read last week?" These questions may have value in helping

students develop a better idea of the reading task and the teacher's instructional goals. The researcher should also determine how the teacher handles the students' questions. Does he answer them directly? Does he encourage the student to answer the question himself? Or does he have other students attempt to answer the question?

Similar research should be done on questions that students ask during or after reading assignments. The researcher might encounter a problem if a significant period of time elapses between students' actual reading of the assignment and a classroom opportunity in which they can ask questions about it; they might forget the questions they wanted to ask. To solve this problem, the researcher might suggest to teachers that they ask students to write down questions which occur while reading the assignment. This procedure should stimulate the development of student questions and provide a more complete sample for the researcher to analyze.

The above recommendations deal with questions that students ask their teacher. Researchers should also consider the possibility of investigating questions that students ask other persons, especially other students. Since such questions are probably rare, researchers will need to develop procedures for stimulating their occurrence. One approach would be to train teachers to have students ask questions of each other about what they have read.

The most subtle type of student question is that which occurs when the student takes an active approach to reading; he generates questions and then attempts to answer them for himself. These questions might take such forms as: "What is the author really trying to say?"; "How can I

use this information in my work?"; "Should I believe the author's predictions and recommendations?" "Why did the story have to end this way?" The self-generated, self-answered question in reading, to my knowledge, has not been dealt with in the literature on reading. Probably this is because it is such an elusive phenomenon to study. There is a need for researchers to document the existence of this type of question and to assess its significance in the reading process.

Undoubtedly, researchers will continue to develop and validate training programs dealing with student questions such as that produced by Blank and Covington. The chief problem that they will face is the lack of sophisticated basic research concerned with the function of students' questions in reading instruction.

PROGRAMS TO IMPROVE TEACHER QUESTIONING SKILLS

Review

Some researchers have turned their attention to the development and validation of programs for improving teachers' questioning practices. More than 30 years ago, Houston (1938) developed an inservice education program for this purpose. Among the techniques used were group conferences, stenographic reports of each teacher's lessons, self-analysis, and supervisory evaluation. Examination of quantitative data yielded by pre- and post-training evaluations of eleven teachers indicates that most of the teachers were able to effect substantial changes in specific aspects of their questioning behavior. As a group the teachers increased the percentage of questions relevant to the purpose of the lesson from 41.6% to 67.6%, the percentage of student participation from 40.4% to 56.1%, and the percentage of questions requiring students to manipulate facts from 10% to 18%. There was also a reduction in a number of negative teaching habits such as repeating one's own questions (from 4.8 occurrences to none), repeating students' answers (from 5.5 to .6 occurrences), answering one's own questions (from 3.5 to .3 occurrences), and interrupting of students' responses (from 10.3 to 1.5 occurrences).

Recent studies by Cunningham (1968), Clegg, Farley, and Curran (1969), and Farley and Clegg (1969) also demonstrate the feasibility of training teachers in questioning techniques, particularly in use of higher cognitive questions. However, the training procedures used in these studies

were not developed sufficiently for operational use by teacher educators. To meet this need, a number of regional educational laboratories sponsored by USOE are developing training packages that are rigorously field-tested before being released for general distribution. For example, the Far West Laboratory for Educational Research and Development is developing a series of short training programs called Minicourses, some of which are intended to help teachers improve their questioning techniques (Borg, Kelley, Langer, and Gall, 1970). The Minicourse relies on techniques such as modeling, self-feedback, and microteaching (Allen and Ryan, 1969) to develop teaching skills.

In a field test of Minicourse 1, "Effective Questioning - Elementary Level" (Borg et al, 1970), many highly significant changes in teachers' questioning behavior were found, as determined by comparisons of pre- and post-course videotapes of twenty-minute classroom discussions: an increase in frequency of redirection from 26.7 to 40.9 occurrences; an increase in percentage of thought questions from 37.3% to 52.0%; and an increase in frequency of probing questions from 8.3 to 13.9. As in Houston's program, there was also a reduction in frequency of poor questioning habits: repeating one's questions (from 13.7 to 4.7 occurrences); repeating students' answers (from 30.7 to 4.4 occurrences); and answering one's own questions (from 4.6 to .7 occurrences). A follow-up study of the same sample of teachers revealed that most of these changes have persisted for a period of over three years (Borg, in press).

Another Minicourse, "Higher Cognitive Questioning" (Gall et al, 1971), has been developed to train teachers in Bloom's taxonomy and its application

to classroom questioning. In several field tests Minicourse 9 was found effective in increasing teachers' use of higher cognitive questions, as defined by Bloom's taxonomy. It was also found that after training, teachers asked more probing questions and were able to elicit longer responses from students. Recently Skailand, Elmore, and Scarborough (1972) developed the preliminary version of a module to train teachers in use of questions for developing students' reading comprehension. It also trains teachers in techniques for eliciting student questions as part of reading instruction. This module is part of Minicourse 22, "Teaching Reading Comprehension", which will be of special interest to educators in the field of reading.

The Northwest Regional Educational Laboratory is another research and development organization that is developing training programs in questioning. The program, "Higher Level Thinking Abilities" (McCollum and Duval, 1971), is based in part on the work of Hilda Taba. Another program, "Classroom Questioning Strategies" (Miller, 1971), trains teachers in five basic questioning styles developed by J.J. Gallagher.

Other programs for improving teachers' questioning practices have been developed, though these have generally had more limited objectives than the programs of Houston (1938) and Borg (1970). Shaver and Oliver (1964) trained teachers in the use of questioning methods appropriate to discussion of controversial issues in the social studies. Suchman (1958) identified inquiry skills for science classes; when teachers were trained to use them, there was a significant increase in the number of questions asked by students. In social studies, Taba and her co-workers (1966)

developed a system of teacher training centered around questioning strategies. These questioning strategies were viewed as techniques which teachers could use to develop their students' abilities in forming concepts, explaining cause-and-effect relationships, and exploring implications.

The most readily available, least expensive materials that can be used for training are articles (Morgan and Schreiber, 1969) and books (Grossier, 1964; Sanders, 1966) that have been written on questioning techniques. Their effectiveness in changing teacher behavior has not been studied, however.

Research has been done to determine the relative effectiveness of various procedures for improving teachers' questioning skills. Several of these studies have involved comparisons of visual instruction (films, videotapes) with written instruction. Allen, Berliner, McDonald, and Sobol (1967) compared a videotape of a model teacher who asks a large number of higher cognitive questions with a written transcript of the same teacher's verbal performance. They found that both were equally effective in changing student teachers' higher cognitive questioning behavior. Acheson and Tucker (1971) and Gall et al (1970) obtained similar findings using different videotape and written materials. These materials were used in conjunction with microteaching, which involves both structured practice and feedback.

In two studies, videotape modeling was found to be more effective than other forms of training. J.J. Koran (1969) trained preservice teachers in observation and classification questions commonly used in science classes. His study revealed that a videotape of a model teacher

was more effective than conventional college instruction involving lecture and demonstration in improving teachers' use of such questions. It should be noted that Koran's outcome measure was a paper-and-pencil test, not performance in a classroom situation. Orme's study (1966) also confirms the effectiveness of videotapes of model teaching. He found that a videotape demonstration was significantly more effective than verbal instructions by a supervisor in improving student teachers' use of probing questions. However, unlike Koran's study, Orme used actual teaching performance to measure changes in questioning skill.

Synthesis

These studies demonstrate conclusively that, given appropriate training, teachers are able to make significant improvements in using various questioning skills. Visual presentations (usually videotapes) of model teaching have proved to be quite effective as a training method, although research also suggests that written transcripts of these videotapes are equally useful. Various teacher groups have been included in these studies, but not reading teachers specifically. Therefore, these generalizations should be applied with caution to the training of teachers who specialize in reading.

The methodology of these studies generally has been sound, with a few exceptions. One criticism is the use of paper-and-pencil tests in Koran's study to measure teachers' ability to frame certain types of questions. Writing questions in a test-like situation is quite artificial by comparison with the usual classroom situation in which teachers ask

questions orally. Researchers should avoid measuring performance in an artificial situation as a substitute for performance in a real-life situation, unless they know that performance in the two situations is highly correlated.

Another, more prevalent problem in training studies of the sort described above is the failure to report training procedures adequately. Usually the descriptions are quite brief, which makes it difficult to compare the effects of different procedures. For example, researchers need to report on steps taken to insure equivalence on dimensions such as quality of the materials and length of training. If two training procedures differ on these dimensions, differential effects can be attributed to them rather than to the variable (e.g., visual versus written presentation) manipulated by the researcher. Incomplete descriptions of procedures also make it difficult for researchers to replicate previous findings. Enough information should be given so that an independent investigator can obtain necessary materials from the original developer or recreate them on his own.

Recommendations

Research and development of training programs concerned with questioning skills has occurred, for the most part, outside of reading instruction. There is a real need to develop and validate training materials specifically for reading teachers. Minicourse 22, "Teaching Reading Comprehension", is a step in this direction.

Much research remains to be done comparing the effects of videotapes or films with the effects of equivalent written materials. This problem

has practical significance because videotapes and films are considerably more expensive to produce and distribute than handbooks or other written materials. Available research findings indicate that both types of media are effective. However, researchers need to carry out replication studies involving other questioning skills (usually the focus has been on higher cognitive questioning) and other teacher groups. We also need to determine whether teachers have favorable attitudes toward more and less expensive training media, not just how well they learn from each. Still another research problem concerns aptitude-treatment interactions (see, for example, M. Koran, 1969). Possibly teachers with certain personality characteristics or aptitudes learn better from viewing filmed examples of skills, whereas teachers with other characteristics benefit more by studying examples in written form.

It should be noted that these research issues concern only teaching skills that are verbal in nature. A researcher would be hard-pressed to develop videotape and handbook examples of classroom teaching involving a nonverbal skill such as use of facial expressions and gestures. The researcher's only recourse is to use a visual medium such as videotape, film, or possibly slide-tape. However, verbal skills can be represented in written form by presenting pertinent examples of classroom dialogue, either teacher alone or teacher-student interaction. The critical research problem, of course, is whether the written presentation is an effective training method.

At present it is a time-consuming, expensive precedure to make behavioral observations of teachers' questioning skill. Usually pre- and post-training videotapes are made, and then these are observed by trained

raters, who tally frequencies with which various questioning skills are used. Research is needed to determine the feasibility of developing measures that are more economical, yet still valid. One possibility is the use of paper-and-pencil tests, as in J.J. Koran's study (1969). A researcher would first develop such tests for several questioning skills and administer them to a sample of teachers. To validate these tests, he would then make behavioral observations of the same skills in the same teacher sample, and determine the extent to which scores on the two types of measures are correlated.

In the studies reviewed above, the training procedures usually require the teacher to engage in some form of practice and feedback after exposure to visual or written instruction. But how much practice and feedback? And of what type? Given teachers' busy schedules, both pre-service and inservice, researchers need to develop training programs that are brief, yet efficient. Borg et al (1970) have suggested various types of practice and feedback variables that can be manipulated in experimental research studies.

CONCLUSION

In this review I have described some of the main research findings and issues that center around teachers' use of questions in classroom instruction. Although research in this area spans a period of over fifty years, much still remains to be done. However, there is one clearcut priority. The major reason for advocating any teaching strategy, including questioning, is that it helps students to learn. At present, we have only a slim basis for asserting that any questioning strategy affects student behavior positively. Reading researchers can help overcome this problem by developing theories of how various questioning strategies promote student reading skills, and then testing them through empirical research.

Table 1
Representative Question-Classification Systems

Author	Classification				
	Recall	Analytic thinking	Creative thinking	Evaluative thinking	Other
Adams (1964)	Memory	Ratiocinative (logical reasoning)	—	Evaluative	Associative, clarifying, neutral
Aschner (1961)	Remembering	Reasoning	Creative thinking	Evaluating	—
Bloom (1956)*	Knowledge	Analysis	Synthesis	Evaluation	Comprehension, application
Carner (1963)	Concrete	Abstract	Creative	—	—
Clements (1964)	Past experience, process recall	—	Planning	Product judgment	Present experience, rule, opening, identification, suggestion, order, acceptance
Guszak (1967)	Recognition, recall	Explanation	Conjecture	Evaluation	Translation
Pate & Bremer (1967)	Simple recall of one item, recall-choice of multiple items	Principle involved, concept analysis	Divergence	—	Determination of skills abilities (demonstrate), skills demonstration (verbal), example-singular, examples-multiple
Schreiber (1967)	Recall of facts, arranging facts in sequential order	Making comparisons, identifying supporting facts, drawing conclusions	Speculating on outcomes	Identifying main part & important parts, stating moral judgment, stating judgment based on personal experience, evaluating quality of source material, evaluating adequacy of data	Describing situations, defining & clarifying information, using globes, using maps, uncovering information & raising questions for study

*In the complete system, each category is divided into sub-categories.

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TABLE 2

BARRETT'S TAXONOMY OF READING COMPREHENSION

1.0 LITERAL COMPREHENSION

- 1.1 Recognition or recall of details
- 1.2 Recognition or recall of main ideas
- 1.3 Recognition or recall of sequence
- 1.4 Recognition or recall of comparisons
- 1.5 Recognition or recall of cause and effect relationships
- 1.6 Recognition or recall of character traits

2.0 INFERENTIAL COMPREHENSION

- 2.1 Inferring supporting details
- 2.2 Inferring the main idea
- 2.3 Inferring sequence
- 2.4 Inferring comparisons
- 2.5 Inferring cause and effect relationships
- 2.6 Inferring character traits
- 2.7 Predicting outcomes
- 2.8 Inferring about figurative language

3.0 EVALUATION

- 3.1 Judgments of reality or fantasy
- 3.2 Judgments of fact or opinion
- 3.3 Judgments of adequacy or validity
- 3.4 Judgments of appropriateness
- 3.5 Judgments of worth, desirability, or acceptability

4.0 APPRECIATION

- 4.1 Emotional response to the content
- 4.2 Identification with characters and incidents
- 4.3 Reactions to the author's use of language
- 4.4 Imagery

TABLE 3 *

PERCENTAGES OF EACH QUESTION TYPE
IN GRADES TWO, FOUR, AND SIX

GRADE	RECOGNITION %	RECALL %	TRANSLATION %	CONJECTURE %	EXPLANATION %	EVALUATION %
Two	12.3	66.5	.2	5.7	3.8	11.5
Four	16.3	48.4	.6	6.9	7.4	20.4
Six	10.2	47.6	2.4	7.9	8.1	13.8
TOTAL	13.5	56.9	.6	6.5	7.2	15.3

* From Guszak, 1967, page 229.

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